



KINGDOM OF MOROCCO
MINISTRY OF COUNTRY PLANNING, WATER AND ENVIRONMENT
DIRECTORATE GENERAL OF HYDRAULICS

THE MASTER PLAN STUDY ON FLOOD FORECASTING AND WARNING SYSTEM FOR ATLAS REGION IN THE KINGDOM OF MOROCCO

FINAL REPORT

VOLUME 4 DATA BOOK



JANUARY 2004



SSS
JR
03-164

JAPAN INTERNATIONAL COOPERATION AGENCY

**KINGDOM OF MOROCCO
MINISTRY OF COUNTRY PLANNING, WATER AND ENVIRONMENT
DIRECTORATE GENERAL OF HYDRAULICS**

**THE MASTER PLAN STUDY ON
FLOOD FORECASTING AND WARNING SYSTEM
FOR ATLAS REGION IN THE KINGDOM OF MOROCCO**

FINAL REPORT

VOLUME 4 DATA BOOK

JANUARY 2004

**CTI ENGINEERING INTERNATIONAL CO., LTD.
YACHIYO ENGINEERING CO., LTD.**

The cost estimates in this Study are based on the prices levels indicated below and expressed in Moroccan Dirham according to the following exchange rates:

USD 1.00 = Dh 9.8638 = JPY 120.590

As of August 1, 2003

COMPOSITION OF FINAL REPORT

Volume 1 SUMMARY REPORT

Volume 2 MAIN REPORT

Volume 3 SUPPORTING REPORT

APPENDIX A AERIAL PHOTOGRAPHY AND GROUND SEUVEY

APPENDIX B GEO-MORPHOLOGY

APPENDIX C HYDROLOGICAL AND HYDRAULICS ANALYSIS

APPENDIX D HYDRAULIC SIMULATION

APPENDIX E SOCIAL SURVEY

APPENDIX F TOURISM

APPENDIX G ENVIROMENTAL CONSIDERATIONS

APPENDIX H STRUCTURAL MEASURES

APPENDIX I TELEMETRY AND WARNING SYSTEM

APPENDIX J OBSERVATION FACILITY

APPENDIX K ECONOMIC EVALUATION

APPENDIX L INSTITUTION

Volume 4 DATA BOOK

**THE MASTER PLAN STUDY ON
FLOOD FORECASTING AND WARNING SYSTEM
FOR ATLAS REGION IN THE KINGDOM OF MOROCCO**

DATA BOOK

TABLE OF CONTENTS

I.	RADIO PROPAGATION TEST -----	I – 1
II.	SOLAR PANEL BATTERY POWER CALCULATION -----	II – 1
III.	PILOT PROJECT INSPECTION DATA -----	III – 1
IV.	PILOT PROJECT INSTALLATION DRAWINGS -----	IV – 1
V.	PHOTO ALBUM OF INSTALLATION OF PILOT PROJECT (PHASE-I) ---	V – 1
VI.	PHOTO ALBUM OF INSTALLATION OF PILOT PROJECT (PHASE-II) --	VI – 1
VII.	SEMINAR TEXT (10-11 OCT 2000) -----	VII – 1
VIII.	SEMINAR TEXT (12 DEC 2001) -----	VIII – 1
IX.	SEMINAR TEXT (5 NOV 2003) -----	IX – 1

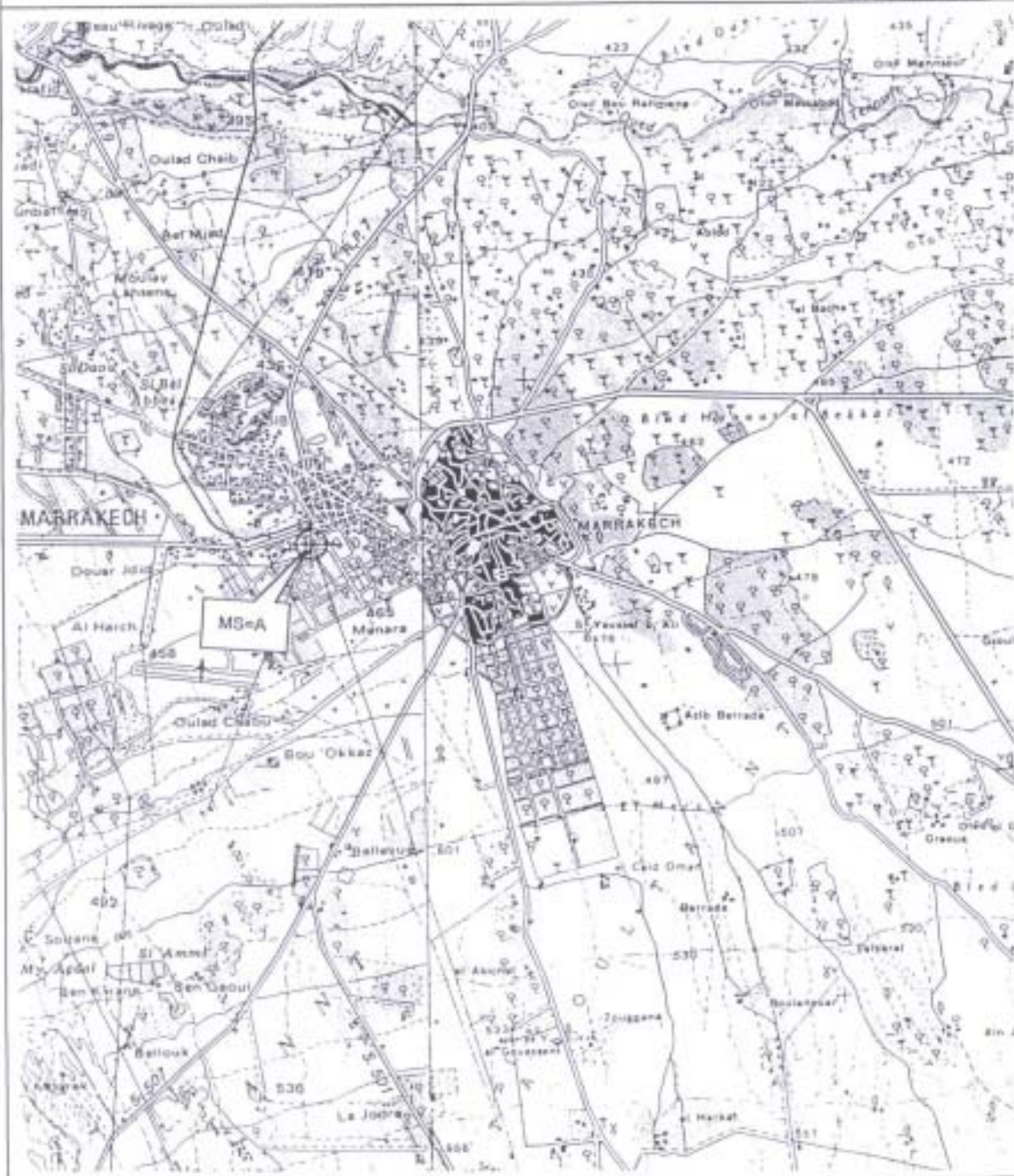
I. RADIO PROPAGATION TEST

LOCATION MAP

Station Code :	LOCATION
----------------	----------

[illegible]

Map Scale : 1/100,000



LOCATION MAP

Station Code :	LOCATION	
RP=A	Oukaimeden	W 7° 51' 46" N 31° 11' 6"
RP=G	Adrar Tazaina	W 7° 43' 55" N 31° 10' 29"
TM=05	Amenzal	W 7° 43' 13" N 31° 10' 23"
TM=06	Tioundou	W 7° 44' 40" N 31° 12' 12"
TM=07	Agouns	W 7° 48' 3" N 31° 11' 49"

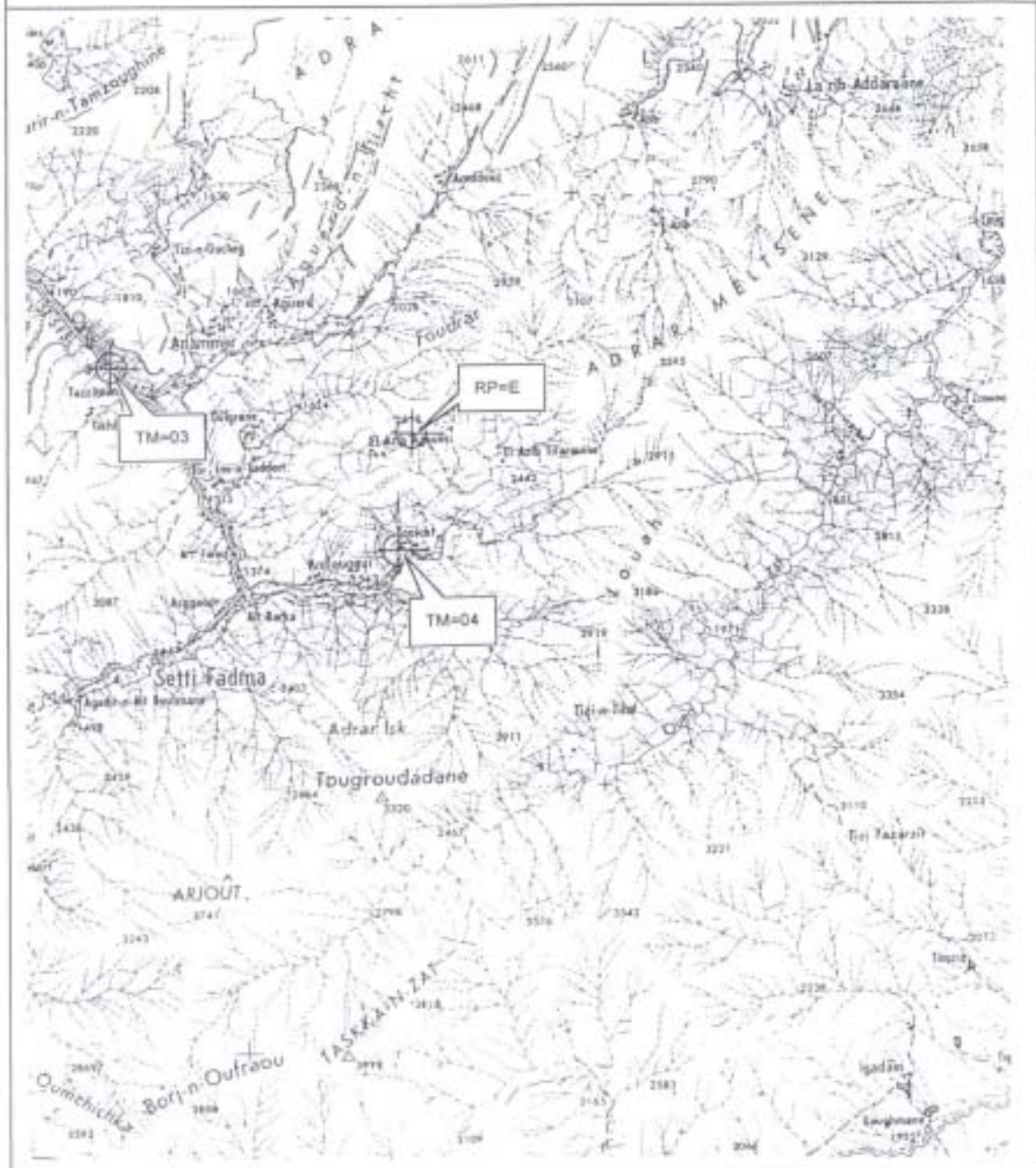
Map Scale : 1/100,000



LOCATION MAP

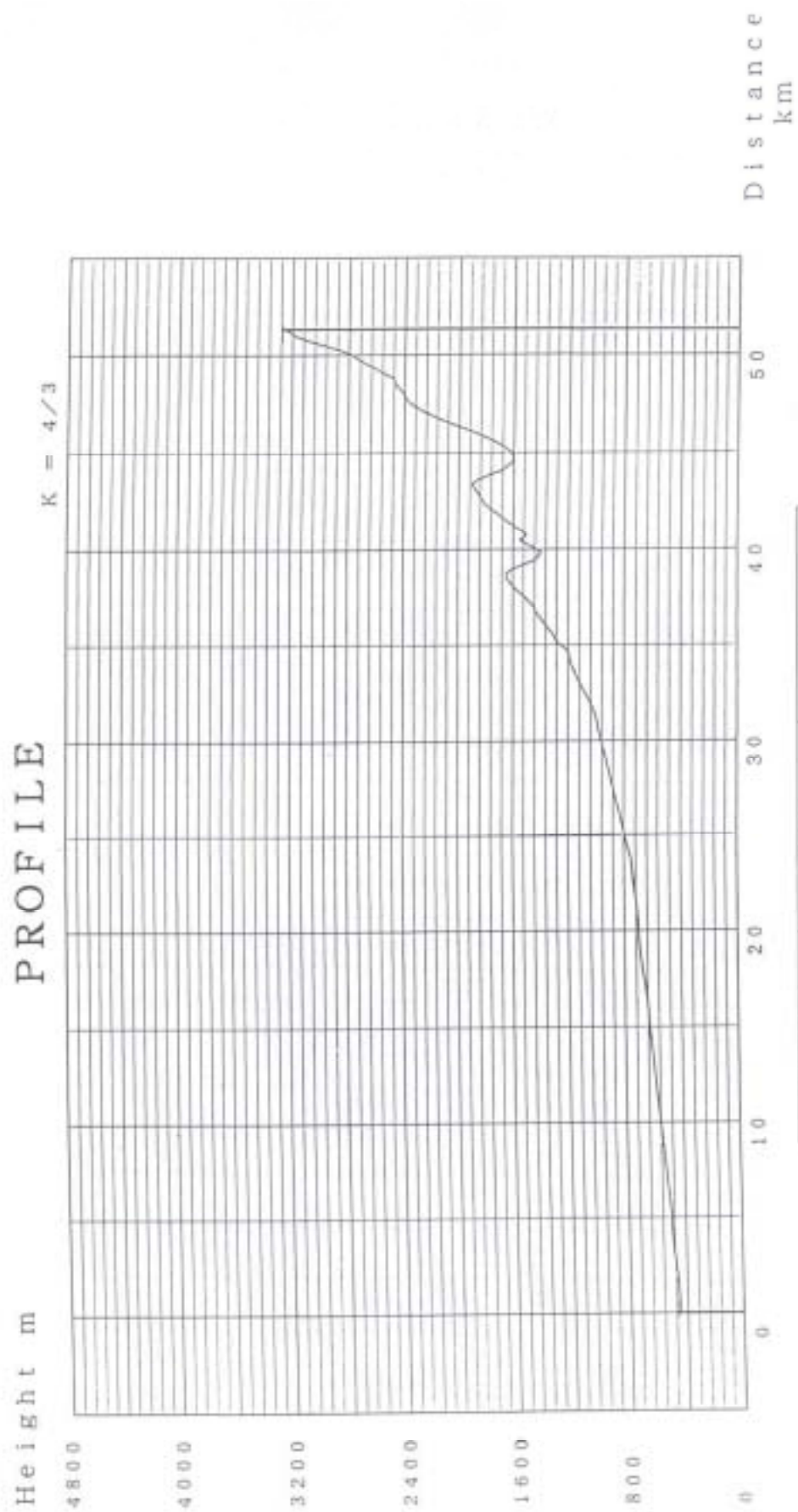
Station Code :		LOCATION	
RP=E	Setti Fadma	W 7°, 37', 34"	N 31°, 15', 36"
TM=03	Tazzount	W 7°, 41', 21"	N 31°, 16', 46"
TM=04	Touche	W 7°, 37', 49"	N 31°, 14', 30"

Map Scale : 1/100,000



88MHz Radio Path

Span				Desk Plan			
Item				MS=A - RP=A (51.3Km)			
Transmit power $10\log P(W)+30$		Pt	dBm	40	10W		
Free space Loss $30\log (fxD)+32.4$		Lpf	dB	-105.5			
Shadow Loss	Knife Edge	Lps	dB	0			
	Plane earth Loss	LAL	dB	0			
	Topography C	tf	dB	0			
Adjustment		Z	dB				
Antenna Loss	Feeder Loss T	Lft	dB	-1.4	10D-2V 30m		
	Feeder Loss R	Lfr	dB	-1.4	10D-2V 30m		
	Coaxial Arrester	Lfa	dB	0			
	Ant. Angle Loss		dB	0	T-0, R-0		
	Duplexer Loss	Lfp	dB	0			
Antenna Gain (T)		Gat	dB	2	Sleeve		
Antenna Gain (R)		Gar	dB	2	Sleeve		
Receiving Voltage			dB/ μv	48.7			
Receiving Power		Pr	dBm	-64.3			
Internal Noise P $10\log B+NF-144$		Prni	dBm	-125.2	B=12KHz NF=8dB		
External Noise P. $dBf\hat{E}v-113$		Prne	dBm	-121.9	Noise defect 5dB		
Receive Noise P. $1/Prni+1/Prne$		Prn	dBm	-120.2			
Radio frequency S/N		C/N	dB	55.9			
S/N Improvement $10\log 3fd\sim 2xB/2fm\sim 3$		I	dB	9.1	fd=3.5KHz fm=3KHz		
Standard S/N		S/N	dB	65			
Fading Loss		fd	dB	8.1	0.1dB/Km +3dB		
Fading S/N		SNfd	dB	56.9			
Threhold Level $Prn+(S/NL-I)$		PL	dBm	-99.3			
Margin to Threshold Level PL-Pr		ML	dB	35			
Fading Margin to Threshold Level		Mf	dB	26.9			
Overall S/N			dB				
Remarks Transmission Antenna Height = 470m Receiving Antenna Height = 3270m P. = Power							

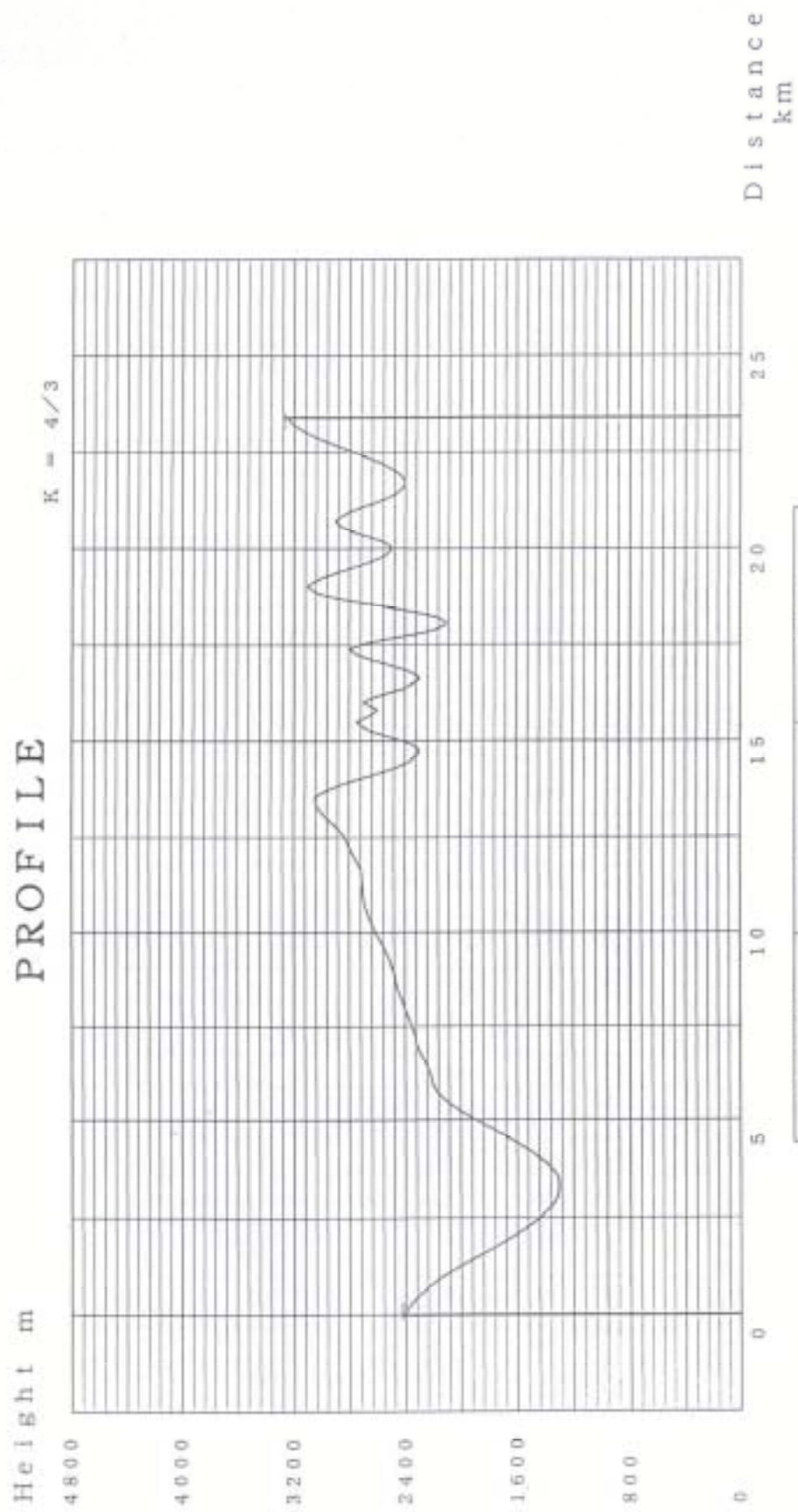


Station	MS=A	RP=A
Height/GL	470m/20m	3270m/20m
Direction		
Distance	51.3 km	

Scale = 60 km / 4800m

88MHz Radio Path

Span			Desk Plan			
Item			RP=E - RP=A (23.4Km)			
Transmit power 10log P(W)+30	Pt	dBm	40	10W		
Free space Loss 30Log (fxD)+32.4	Lpf	dB	-98.7			
Shadow Loss	Knife Edge	Lps	dB	-17		
	Plane earth Loss	LAL	dB	0		
	Topography C	tf	dB	-10		
Adjustment		Z	dB			
Antenna Loss	Feeder Loss T	Lft	dB	-1.4	10D-2V 30m	
	Feeder Loss R	Lfr	dB	-1.4	10D-2V 30m	
	Coaxial Arrester	Lfa	dB	0		
	Ant. Angle Loss		dB	0	T-0, R-0	
	Duplexer Loss	Lfp	dB	0		
Antenna Gain (T)	Gat	dB	2	Sleeve		
Antenna Gain (R)	Gar	dB	2	Sleeve		
Receiving Voltage		dB/ μv	28.5			
Receiving Power	Pr	dBm	-84.5			
Internal Noise P 10LogB+NF-144	Prni	dBm	-125.2	B=12KHz NF=8dB		
External Noise P. dBfÊv-113	Prne	dBm	-121.9	Noise defect 5dB		
Receive Noise P. 1/Prni+1/Prne	Prn	dBm	-120.2			
Radio frequency S/N	C/N	dB	35.7			
S/N Improvement 10Log3fd~2xB/2fm~3	I	dB	9.1	fd=3.5KHz fm=3KHz		
Standard S/N	S/N	dB	44.8			
Fading Loss	fd	dB	5.3	0.1dB/Km +3dB		
Fading S/N	SNfd	dB	39.5			
Threhold Level Prn+(S/NL-I)	PL	dBm	-99.3			
Margin to Threshold Level PL-Pr	ML	dB	14.8			
Fading Margin to Threshold Level	Mf	dB	9.5			
Overall S/N		dB				
Remarks Transmission Antenna Height = 2420m Receiving Antenna Height = 3270m P. = Power						

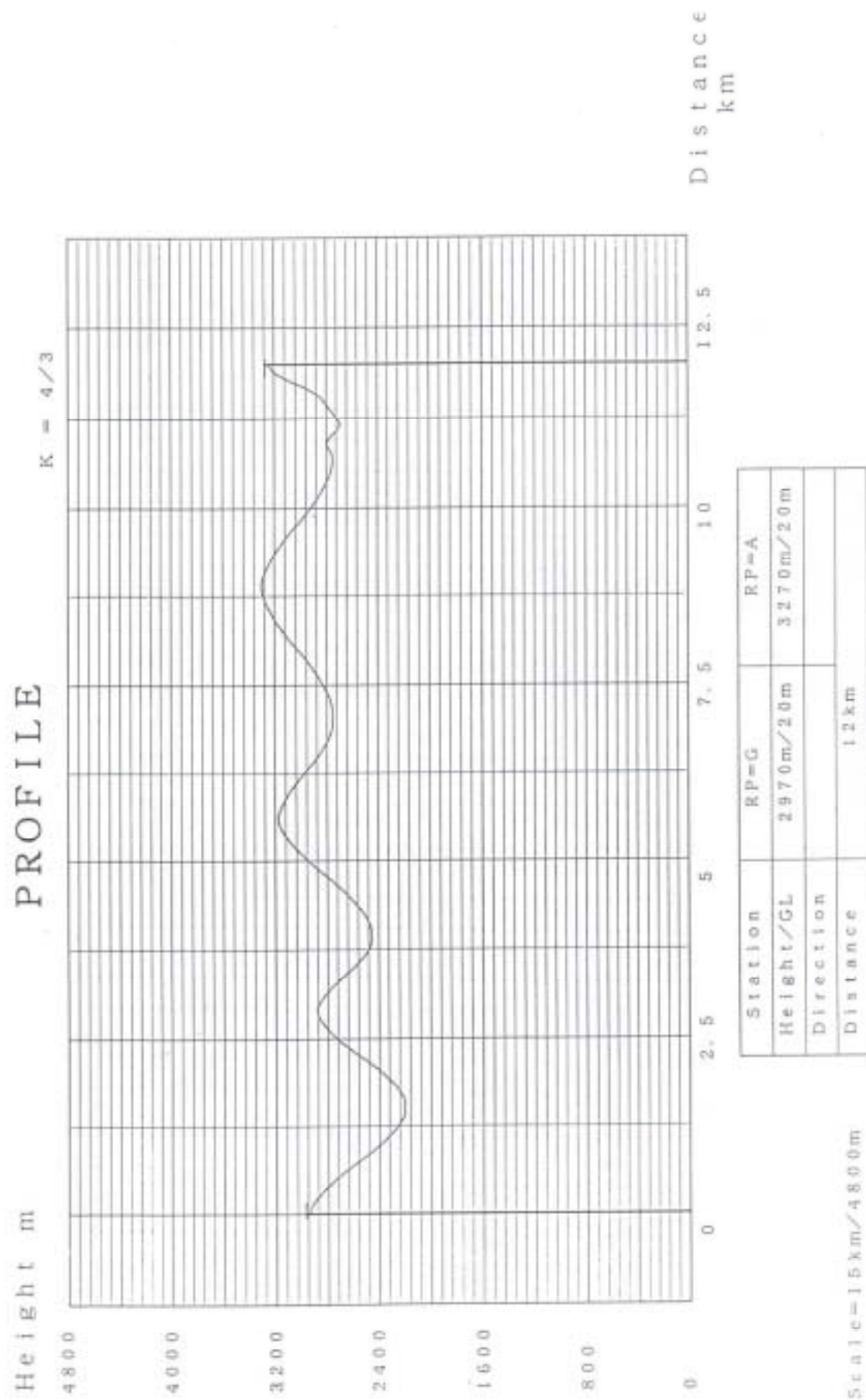


Station	RP=E	RP=A
Height/GL	2420m/20m	3270m/20m
Direction		
Distance	23.4 km	

Scale=30 km/4800m

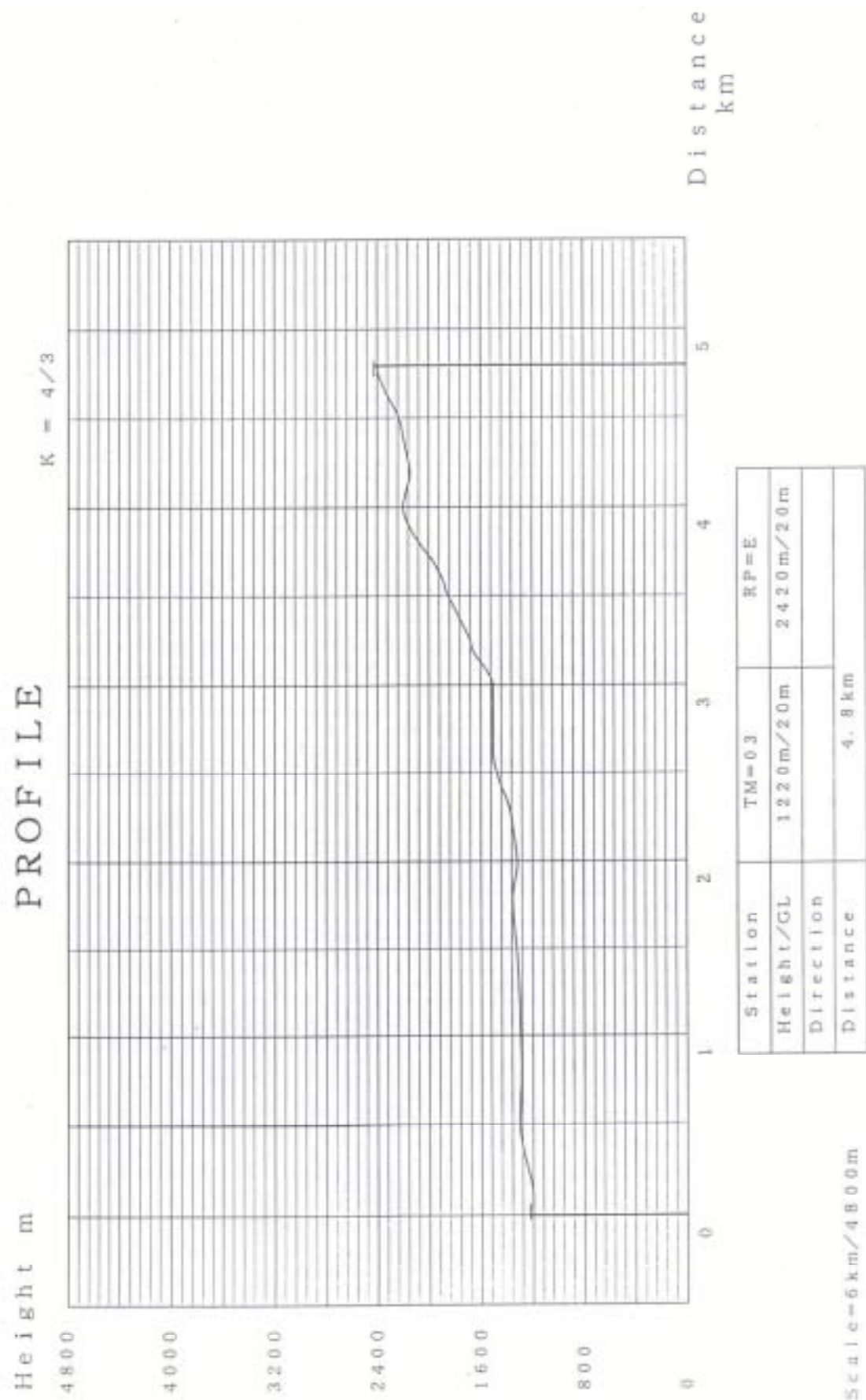
88MHz Radio Path

Span				Desk Plan			
Item				RP=G - RP=A (12Km)			
Transmit power 10log P(W)+30		Pt	dBm	40	10W		
Free space Loss 30Log (fxD)+32.4		Lpf	dB	-92.9			
Shadow Loss	Knife Edge	Lps	dB	-23.6			
	Plane earth Loss	LAL	dB	0			
	Topography C	tf	dB	-10			
Adjustment		Z	dB				
Antenna Loss	Feeder Loss T	Lft	dB	-1.4	10D-2V 30m		
	Feeder Loss R	Lfr	dB	-1.4	10D-2V 30m		
	Coaxial Arrester	Lfa	dB	0			
	Ant. Angle Loss		dB	0	T-0, R-0		
	Duplexer Loss	Lfp	dB	0			
Antenna Gain (T)		Gat	dB	2	Sleeve		
Antenna Gain (R)		Gar	dB	2	Sleeve		
Receiving Voltage			dB/ μv	27.7			
Receiving Power		Pr	dBm	-85.3			
Internal Noise P 10LogB+NF-144		Prni	dBm	-125.2	B=12KHz NF=8dB		
External Noise P. dBfÊv-113		Prne	dBm	-121.9	Noise defect 5dB		
Receive Noise P. 1/Prni+1/Prne		Prn	dBm	-120.2			
Radio frequency S/N		C/N	dB	34.9			
S/N Improvement 10Log3fd~2xB/2fm~3		I	dB	9.1	fd=3.5KHz fm=3KHz		
Standard S/N		S/N	dB	44			
Fading Loss		fd	dB	4.2	0.1dB/Km +3dB		
Fading S/N		SNfd	dB	39.8			
Threhold Level Prn+(S/NL-I)		PL	dBm	-99.3			
Margin to Threshold Level PL-Pr		ML	dB	14			
Fading Margin to Threshold Level		Mf	dB	9.8			
Overall S/N			dB				
Remarks							
Transmission Antenna Height				=	2970m		
Receiving Antenna Height				=	3270m		
P.				=	Power		



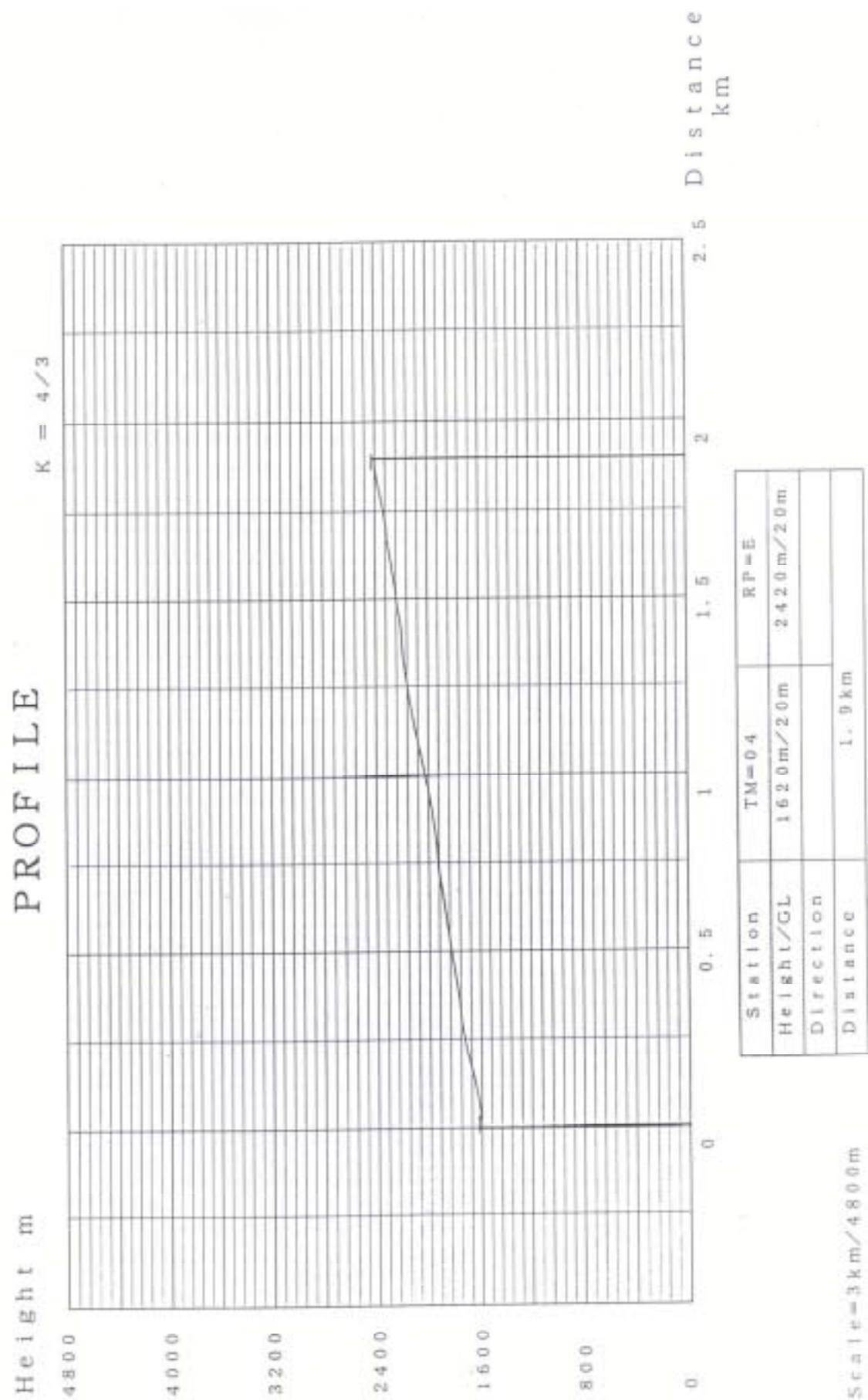
88MHz Radio Path

Span Item			Desk Plan			
			TM=03 - RP=E (4.8Km)			
Transmit power 10log P(W)+30	Pt	dBm	40	10W		
Free space Loss 30Log (fxD)+32.4	Lpf	dB	-84.9			
Shadow Loss	Knife Edge	Lps	dB	-1.7		
	Plane earth Loss	LAL	dB	0		
	Topography C	tf	dB	-10		
Adjustment		Z	dB			
Antenna Loss	Feeder Loss T	Lft	dB	-1.4	10D-2V 30m	
	Feeder Loss R	Lfr	dB	-1.4	10D-2V 30m	
	Coaxial Arrester	Lfa	dB	0		
	Ant. Angle Loss		dB	0	T-0, R-0	
	Duplexer Loss	Lfp	dB	0		
Antenna Gain (T)	Gat	dB	8	3EL Yagi		
Antenna Gain (R)	Gar	dB	2	Sleeve		
Receiving Voltage		dB/ μv	63.6			
Receiving Power	Pr	dBm	-49.4			
Internal Noise P 10LogB+NF-144	Prni	dBm	-125.2	B=12KHz NF=8dB		
External Noise P. dBfÊv-113	Prne	dBm	-121.9	Noise defect 5dB		
Receive Noise P. 1/Prni+1/Prne	Prn	dBm	-120.2			
Radio frequency S/N	C/N	dB	70.8			
S/N Improvement 10Log3fd~2xB/2fm~3	I	dB	9.1	fd=3.5KHz fm=3KHz		
Standard S/N	S/N	dB	79.9			
Fading Loss	fd	dB	3.5	0.1dB/Km +3dB		
Fading S/N	SNfd	dB	76.4			
Threhold Level Prn+(S/NL-I)	PL	dBm	-99.3			
Margin to Threshold Level PL-Pr	ML	dB	49.9			
Fading Margin to Threshold Level	Mf	dB	46.4			
Overall S/N		dB				
Remarks Transmission Antenna Height = 1220m Receiving Antenna Height = 2420m P. = Power						



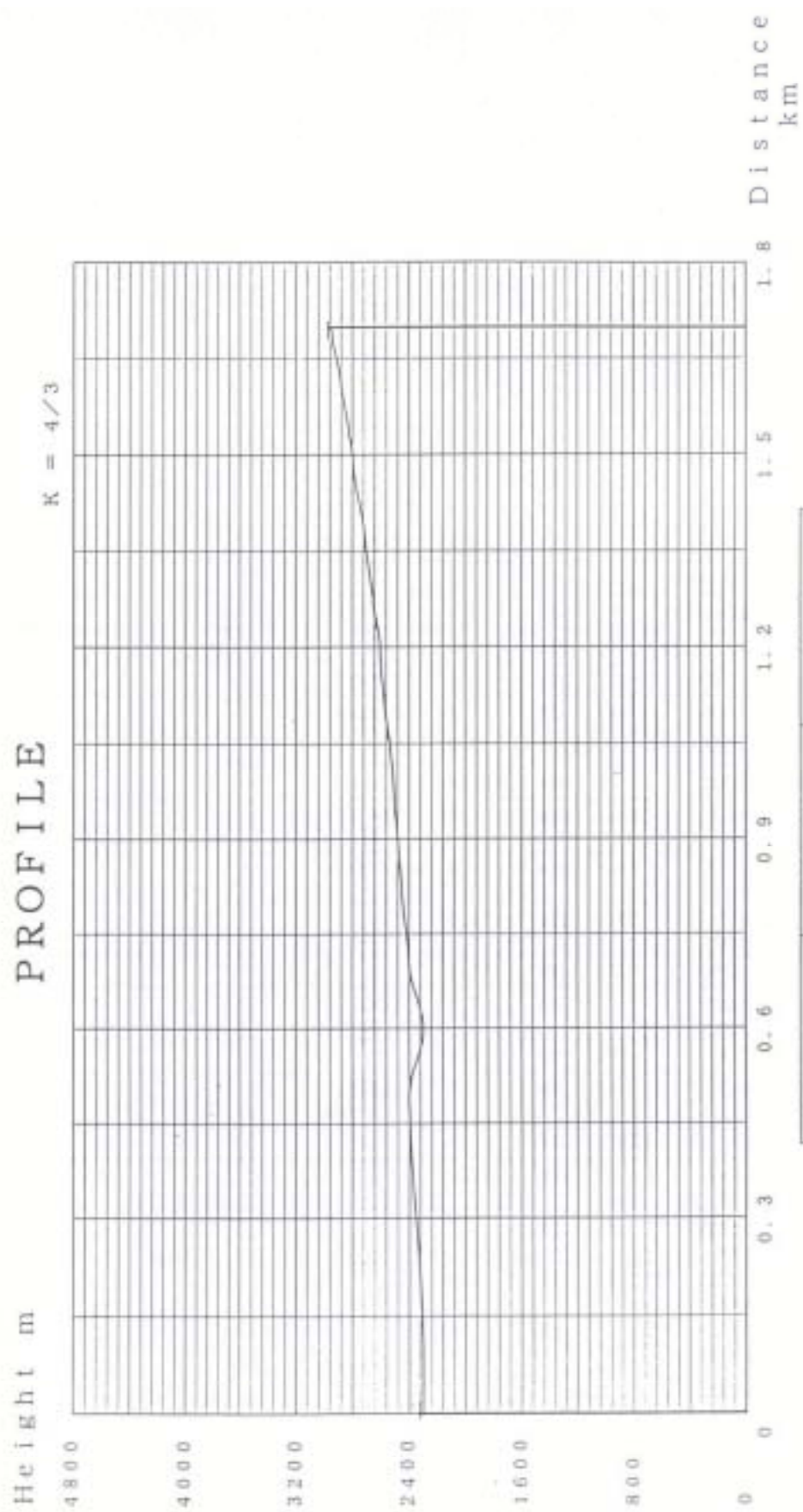
88MHz Radio Path

Span Item				Desk Plan			
				TM=04 - RP=E (1.9Km)			
Transmit power 10log P(W)+30		Pt	dBm	40	10W		
Free space Loss 30Log (fxD)+32.4		Lpf	dB	-76.9			
Shadow Loss	Knife Edge	Lps	dB	0			
	Plane earth Loss	LAL	dB	0			
	Topography C	tf	dB	-10			
Adjustment		Z	dB				
Antenna Loss	Feeder Loss T	Lft	dB	-1.4	10D-2V 30m		
	Feeder Loss R	Lfr	dB	-1.4	10D-2V 30m		
	Coaxial Arrester	Lfa	dB	0			
	Ant. Angle Loss		dB	0	T-0, R-0		
	Duplexer Loss	Lfp	dB	0			
Antenna Gain (T)		Gat	dB	8	3EL Yagi		
Antenna Gain (R)		Gar	dB	2	Sleeve		
Receiving Voltage			dB/ μ	73.3			
Receiving Power		Pr	dBm	-39.7			
Internal Noise P 10LogB+NF-144		Prni	dBm	-125.2	B=12KHz NF=8dB		
External Noise P. dBf $\hat{E}_v$ -113		Prne	dBm	-121.9	Noise defect 5dB		
Receive Noise P. 1/Prni+1/Prne		Prn	dBm	-120.2			
Radio frequency S/N		C/N	dB	80.5			
S/N Improvement 10Log3fd~2xB/2fm~3		I	dB	9.1	fd=3.5KHz fm=3KHz		
Standard S/N		S/N	dB	89.6			
Fading Loss		fd	dB	3.2	0.1dB/Km +3dB		
Fading S/N		SNfd	dB	86.4			
Threhold Level Prn+(S/NL-I)		PL	dBm	-99.3			
Margin to Threshold Level PL-Pr		ML	dB	59.6			
Fading Margin to Threshold Level		Mf	dB	56.4			
Overall S/N			dB				
Remarks Transmission Antenna Height = 1620m Receiving Antenna Height = 2420m P. = Power							



88MHz Radio Path

Span Item				Desk Plan			
				TM=06 - RP=G (1.7Km)			
Transmit power 10log P(W)+30		Pt	dBm	40	10W		
Free space Loss 30Log (fxD)+32.4		Lpf	dB	-75.9			
Shadow Loss	Knife Edge	Lps	dB	-0			
	Plane earth Loss	LAL	dB	0			
	Topography C	tf	dB	-10			
Adjustment		Z	dB				
Antenna Loss	Feeder Loss T	Lft	dB	-1.4	10D-2V 30m		
	Feeder Loss R	Lfr	dB	-1.4	10D-2V 30m		
	Coaxial Arrester	Lfa	dB	0			
	Ant. Angle Loss		dB	0	T-0, R-0		
	Duplexer Loss	Lfp	dB	0			
Antenna Gain (T)		Gat	dB	8	3EL Yagi		
Antenna Gain (R)		Gar	dB	2	Sleeve		
Receiving Voltage			dB/ μ v	74.3			
Receiving Power		Pr	dBm	-38.7			
Internal Noise P 10LogB+NF-144		Prni	dBm	-125.2	B=12KHz NF=8dB		
External Noise P. dBf $\hat{E}$ v-113		Prne	dBm	-121.9	Noise defect 5dB		
Receive Noise P. 1/Prni+1/Prne		Prn	dBm	-120.2			
Radio frequency S/N		C/N	dB	81.5			
S/N Improvement 10Log3fd~2xB/2fm~3		I	dB	9.1	fd=3.5KHz fm=3KHz		
Standard S/N		S/N	dB	90.6			
Fading Loss		fd	dB	3.2	0.1dB/Km +3dB		
Fading S/N		SNfd	dB	87.4			
Threshold Level Prn+(S/NL-I)		PL	dBm	-99.3			
Margin to Threshold Level PL-Pr		ML	dB	60.6			
Fading Margin to Threshold Level		Mf	dB	57.4			
Overall S/N			dB				
Remarks Transmission Antenna Height = 2320m Receiving Antenna Height = 2970m P. = Power							



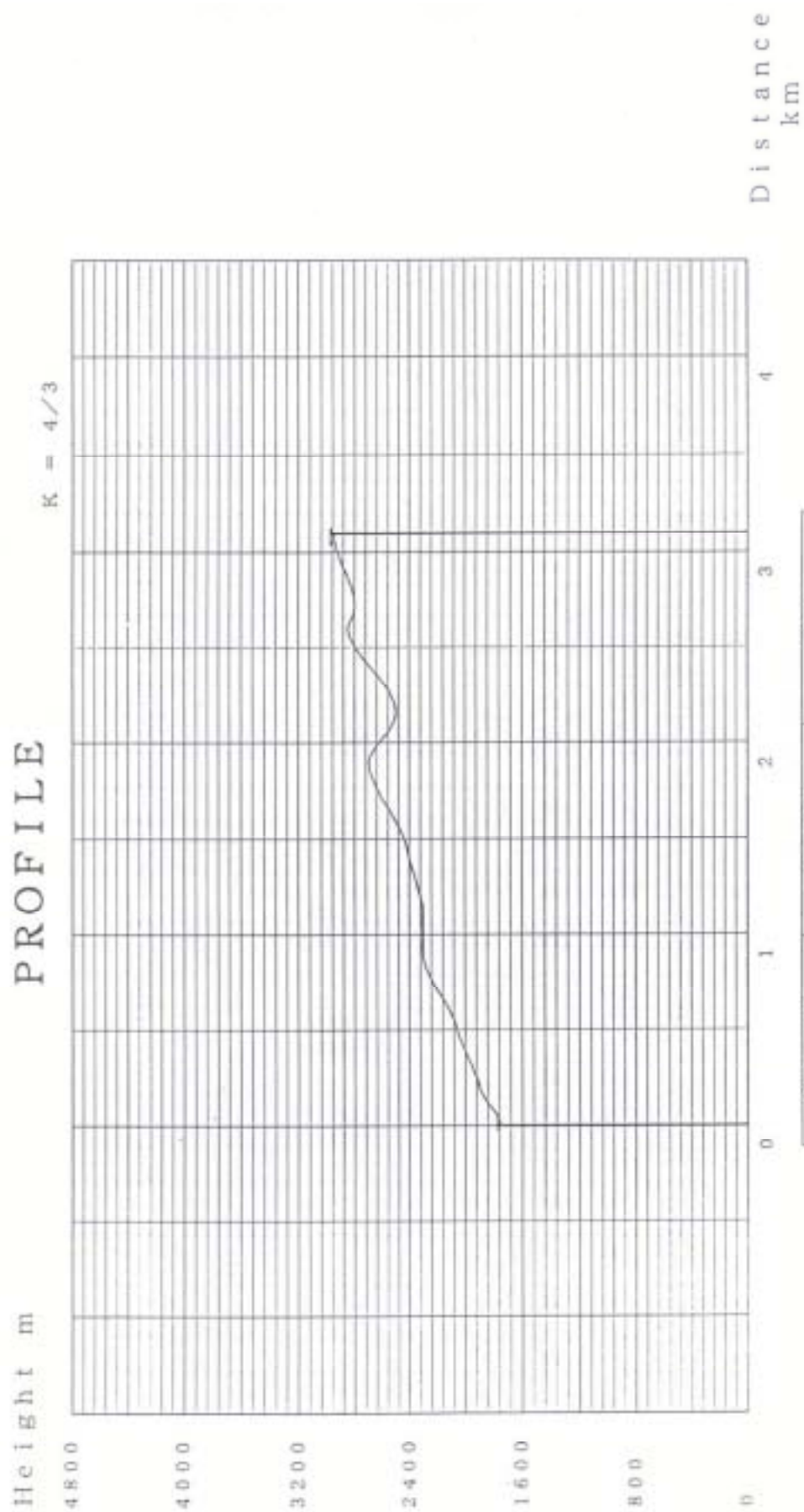
Station	TM=05	RP=G
Height/GL	2320m/20m	2970m/20m
Direction		
Distance	1.7 km	

Scale=1:8 km/4800m

88MHz Radio Path

Span Item				Desk Plan			
				TM=06 - RP=G (3.1Km)			
Transmit power $10\log P(W)+30$		Pt	dBm	40	10W		
Free space Loss $30\log (fxD)+32.4$		Lpf	dB	-81.1			
Shadow Loss	Knife Edge	Lps	dB	-50.5			
	Plane earth Loss	LAL	dB	0			
	Topography C	tf	dB	-10			
Adjustment		Z	dB				
Antenna Loss	Feeder Loss T	Lft	dB	-1.4	10D-2V 30m		
	Feeder Loss R	Lfr	dB	-1.4	10D-2V 30m		
	Coaxial Arrester	Lfa	dB	0			
	Ant. Angle Loss		dB	0	T-0, R-0		
	Duplexer Loss	Lfp	dB	0			
Antenna Gain (T)		Gat	dB	8	3EL Yagi		
Antenna Gain (R)		Gar	dB	2	Sleeve		
Receiving Voltage			dB/ μv	18.6			
Receiving Power		Pr	dBm	-94.4			
Internal Noise P $10\log B+NF-144$		Prni	dBm	-125.2	B=12KHz NF=8dB		
External Noise P. $dBf\hat{E}v-113$		Prne	dBm	-121.9	Noise defect 5dB		
Receive Noise P. $1/Prni+1/Prne$		Prn	dBm	-120.2			
Radio frequency S/N		C/N	dB	25.8			
S/N Improvement $10\log 3fd\sim 2xB/2fm\sim 3$		I	dB	9.1	fd=3.5KHz fm=3KHz		
Standard S/N		S/N	dB	34.9			
Fading Loss		fd	dB	3.3	0.1dB/Km +3dB		
Fading S/N		SNfd	dB	31.6			
Threhold Level $Prn+(S/NL-I)$		PL	dBm	-99.3			
Margin to Threshold Level PL-Pr		ML	dB	4.9			
Fading Margin to Threshold Level		Mf	dB	1.6			
Overall S/N			dB				
Remarks Transmission Antenna Height = 1770m Receiving Antenna Height = 2970m P. = Power							

PROFILE



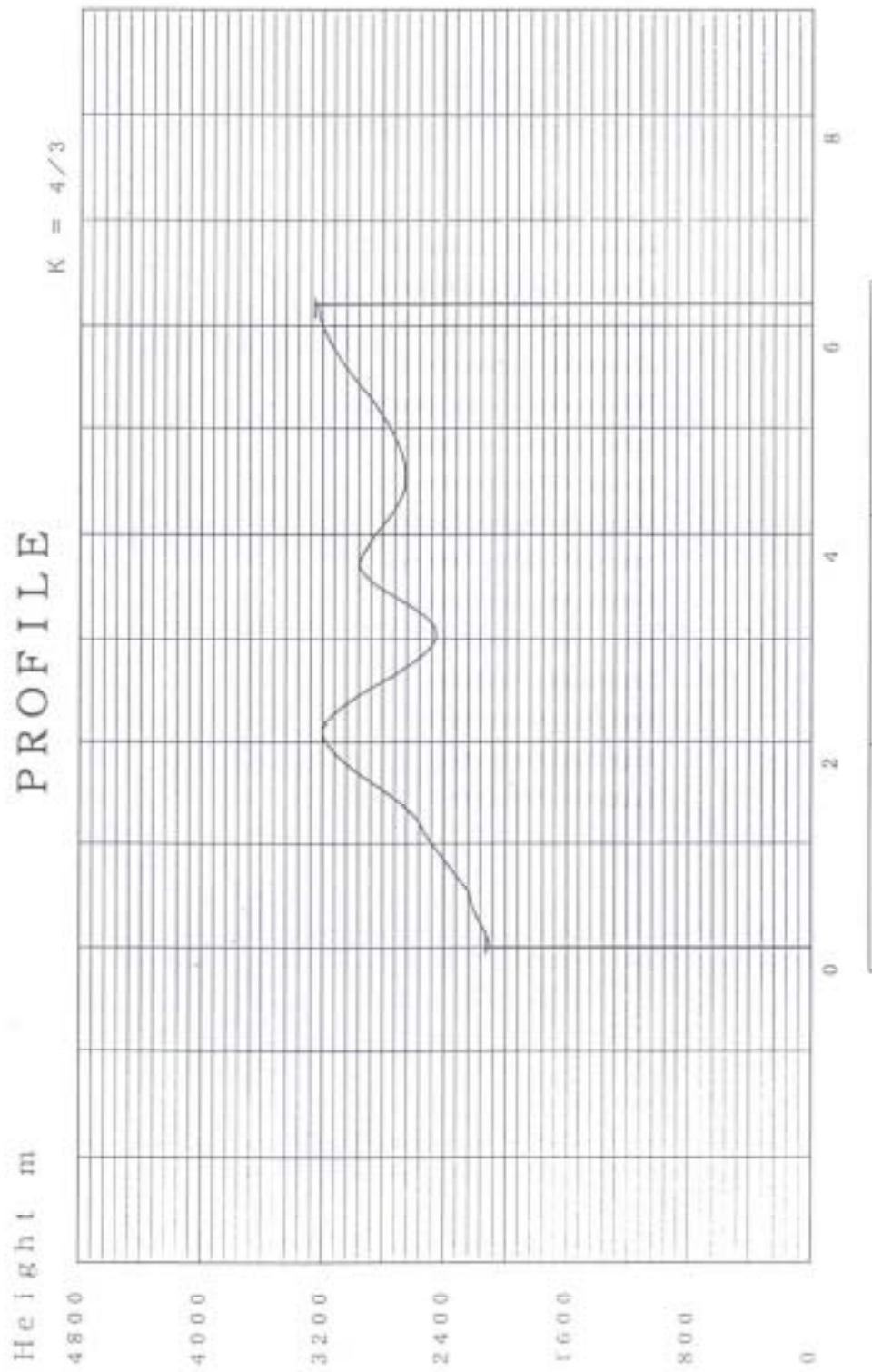
Station	TM=0.6	RP=G
Height/GL	1770m/20m	2970m/20m
Direction		
Distance	3.1 km	

Scale = 6 km / 4800 m

88MHz Radio Path

Span Item				Desk Plan			
				TM=07 - RP=A (6.2Km)			
Transmit power $10\log P(W)+30$		Pt	dBm	40	10W		
Free space Loss $30\log (fxD)+32.4$		Lpf	dB	-87.1			
Shadow Loss	Knife Edge	Lps	dB	-36.1			
	Plane earth Loss	LAL	dB	0			
	Topography C	tf	dB	-10			
Adjustment		Z	dB				
Antenna Loss	Feeder Loss T	Lft	dB	-1.4	10D-2V 30m		
	Feeder Loss R	Lfr	dB	-1.4	10D-2V 30m		
	Coaxial Arrester	Lfa	dB	0			
	Ant. Angle Loss		dB	0	T-0, R-1		
	Duplexer Loss	Lfp	dB	0			
Antenna Gain (T)		Gat	dB	8	3EL Yagi		
Antenna Gain (R)		Gar	dB	2	Sleeve		
Receiving Voltage			dB/ μv	28.5			
Receiving Power		Pr	dBm	-84.5			
Internal Noise P $10\log B+NF-144$		Prni	dBm	-125.2	B=12KHz NF=8dB		
External Noise P. $dBf\hat{E}v-113$		Prne	dBm	-121.9	Noise defect 5dB		
Receive Noise P. $1/Prni+1/Prne$		Prn	dBm	-120.2			
Radio frequency S/N		C/N	dB	35.7			
S/N Improvement $10\log 3fd\sim 2xB/2fm\sim 3$		I	dB	9.1	fd=3.5KHz fm=3KHz		
Standard S/N		S/N	dB	44.8			
Fading Loss		fd	dB	3.6	0.1dB/Km +3dB		
Fading S/N		SNfd	dB	41.2			
Threhold Level $Prn+(S/NL-I)$		PL	dBm	-99.3			
Margin to Threshold Level PL-Pr		ML	dB	14.8			
Fading Margin to Threshold Level		Mf	dB	11.2			
Overall S/N			dB				
Remarks Transmission Antenna Height = 2120m Receiving Antenna Height = 3250m P. = Power							

PROFILE



Station	TM=07	RP=A
Height/GL	2120m/20m	3250m/20m
Direction		
Distance	6.2 km	

Scale=12 km/4800m